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COUNTRY USSR (Moscow Oblast)

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Krasnoarmeysk
2. TROMMSDORF Wind Tunnel, KB-3

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INTRODUCTION

1. At the time of our arrival in Krasnoarmeyskiy, the Design Bureau No. 3 (KB-3) was not equipped with a firing range. For the first year tests on newly designed weapons were executed on the S.N.I.P. firing range [see Report] to which KB-3 was a first subordinated. On the S.N.I.P. range were carried out the tests on "ABRS 220" and the preliminary experiments of "Molnya". During the middle of 1947, KB-3 was gradually weaned from S.N.I.P. and this process was accompanied by the construction of a new test range which was completed towards the end of 1947. Test range is a euphemism, for although the testing facilities on the S.N.I.P. range were primitive, those on the KB-3 range were forbidding, consisting only of the few items listed below [see Para. 6].
2. German personnel, especially the three German designing group leaders SCHAADT, (later BOEHM), TROMMSDORF and myself, had access to the range. Access, however, was restricted to witnessing tests on missiles or other weapons designed by the respective leader's group. Furthermore, prior permission was required from the First Section. My own visits

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to the test range were confined primarily to the period from the end of 1947 to the end of 1948; during this time the emphasis was on the "Molnya" tests which had been earlier started on the S.N.I.P. range. During 1949 I had fewer occasions to visit the range but for a brief period conducted some recoil tests on a project which paralleled work performed by the SCHAADT Group. After 1950 no German personnel with the possible exception of Dr. TROMMSDORF were permitted on the range. For further details on TROMMSDORF's activities, see Report [redacted] dated October 1953.

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LOCATION OF RANGE

3. The test range of KB-3 was located in a meadow approximately five minutes by car from KB-3 along the road to Muromtsevo and in the immediate vicinity of this town. I have prepared a sketch of the test range and for purposes of orientation have also shown KB-3 [see page 10]. The coordinates of the point X on the sketch are: Latitude: 56°07'25" and Longitude: 38°09'10", on U.S. Target Complex Chart, Series 100 # 0154-9969-100.

DESCRIPTION OF RANGE AND FACILITIES

4. The range was a rectangularly shaped enclosure surrounded by barbed wire. Midway through the range and parallel with its length ran a small creek. The exact dimensions of the range are not known to me, but the over-all length of the range was as much as three times the length of the solid line shown on the sketch and in the direction of the intermittent lines. The width of the range was approximately of the order shown on the sketch. The actual firing emplacements were located in the defile in which the creek flowed. Two different firing positions were used for the tests. I observed: (a) firing across the creek in southeastern direction, that is, from one slope into the opposing slope; (b) firing in the northern direction of the creek bed. At the point where the guns were installed, the banks of the creek were very steep and had a depth of approximately 10 to 15 meters.

PERMANENT STRUCTURES

5. The permanent structures on the range (the positions of the buildings are not exact) consisted of the following: [Points refer to numbers shown on the sketch on page 10.]

Point 1 TROMMSDORF's Supersonic Wind Tunnel

[See Paragraphs 11 to 20.]

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Point 2 Powder Filling Station

A single-story Finnish hut divided into three rooms which were used respectively:

- (a) For the weighing of powder charges and the filling of cartridges. (This work was frequently performed by Dr. RACKETT aided by Soviet laborers.)
- (b) For gas pressure tests. Pressure curves were obtained by means of a copper compression cylinder.
- (c) For the storage of Le Boulanger Chronographs.

Point 3 Office Building

Used by Soviet personnel stationed on the firing range and headed by CHIPULIN. [See Report for information on personalities.]

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Point 4 Armored Plates

A number of square-shaped armored plates, .5 x .5 m., were distributed over the test site. Hollow charges effects were tested and analyzed on these blocks.

EQUIPMENT

6. As I mentioned above, the facilities of the KB-3 test range were extraordinarily primitive during the period that the German specialists had access to it. Aside from two guns which were mounted in the depression, a few wooden frames for targets, and boulanger measurements, nothing else was available. As far as I know, however, plans were made to enlarge the testing facilities. Among other things it was planned to construct a horizontal test stand for missile combustion chambers with a maximum of 100-ton thrust. Additional details are not known to me. It is interesting to note in regard to equipment that a complete cine-theodolite in the form of a German-made "Askania-Station" was available at KB-3. However, this unit was never used by the German or Soviet engineers. As far as I know, this was due to the fact that no Soviet personnel were trained in its use although we once drew up a detailed memorandum on the use of the "Askania-Station" together with proposals for the organization of a special servicing unit. The equipment that was available on the range consisted of the following:

Cannon - A standard 10 cm. cannon of Soviet make. The cannon was provided with an antiaircraft barrel which had been machined to a caliber of 105 and whose rifling had been removed.

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Le Boulanger Frames - Simple wooden frames enclosing a square wire mesh. In firing tests across the creek, the frames were placed in line with the gun, (see sketch), the one nearest the gun being at a distance of 5 to 8 m. The distance between the frames was 20 to 30 m. When firing across the slope, the distance between gun and target was 150 to 200 m.

Recoilless Test Barrel - A shorter barrel than the one used in the cannon above but also machined to 105 cal. was suspended from two pylons as shown in the detail on the sketch. This suspension permitted the free movement of the barrel. The system was connected with instruments which measured the amplitudes of the pendulum swings and thus could be used to adjust the recoil by altering the jet cross-section.

ACTIVITY ON THE RANGE

7. Tests on the range were conducted exclusively by Soviet personnel under CHIPULIN. The German group leader responsible for the model tested was during the first years required to be present during the testing but was not permitted to interfere with the test procedure. Prior to the test the German was required to draw up an itemized schedule for the test which was then approved by the Soviet chief of KB-3. The test schedule was rigorously followed by the Soviet range personnel. The schedule went into such minute detail that no initiative was required on the part of the Soviet personnel. At the very best, the German could request that the test be stopped altogether. In that case a new schedule had to be drawn up and approved and a new date set for the testing.
8. Experiments involving our group and which I witnessed were virtually confined to the "Molnya" project. These tests dealt with the "mines" (projectiles) of Molnya and were conducted throughout 1948. The very first "mines" were fired from bank to bank across the creek. Later we fired along the axis of the creek using an elevation of 3 to 5 degrees. For these tests we used the cannon with the FLAK barrel described above [Para. 6]. Muzzle velocities of 80 to 100 m./sec. were used. Also tested in my presence was the "mine-ejection operation" of the Molnya. This took the form of stationary tests whereby the piston ejected the mines from the magazines, and the dispersion pattern of the mines was obtained.
9. The other German groups, SCHAADT and TROMMSDORF, carried out tests on the range as well. SCHAADT's tests dealt with the "Panzerfaust", but details are not known to me. TROMMSDORF was at the range while the supersonic tunnel which he had designed was constructed and possibly afterwards.

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Soviet Activity

10. Tests by Soviet engineers of KB-3 in the absence of German specialists were also carried out on the testing site. Since the Soviet modus operandi required the presence of the project author at tests, I infer that the tests of the Soviets dealt with missiles that were designed by the Soviet engineers themselves. These may have been modifications of the missiles developed by the German groups or they may have been entirely independently designed missiles. Of course this inference does not preclude the possibility that the Soviets deviated from their SOP and had the Soviet engineers conduct tests on the German-designed missiles in the absence of the design's German author. I believe that among other things the Soviets conducted tests on the HS-15. I no longer am able to offer concrete evidence for this belief, but I do know that one (or more) assembled HS-15 was stored at KB-3. That Soviet engineers used the range is based on the fact that we frequently were forced to wait before commencing with our testing in order to let the Soviet engineers on the range complete their own tests. On one of these occasions we learned that ULYANOV was engaged in the testing of a Soviet parallel development to the SCHAALT Group's "Panzerfaust" and that a projectile had exploded while still in the barrel. The personnel of the range told us that the same thing had occurred the previous day and that now two stationary test units had been destroyed. In this connection it is interesting to note the somewhat incongruous approach of the Soviets in these tests. Instead of gradually increasing the powder charge of the test unit, they would immediately use the full powder charge on the first test with the result that explosions similar to the ULYANOV one must have been quite common.

TROMMSDORF'S SUPERSONIC WIND TUNNEL ON THE KB-3 RANGEGeneral

11. Soon after our arrival at KB-3 in Krasnoarmeyskiy, Dr. TROMMSDORF was charged by the Soviets with the design and construction of a replica of the wind tunnel that TROMMSDORF had built in Kammersdorf, Germany, during the war. The construction of the tunnel was supervised by an unidentified Soviet architect from the S.N.I.P. firing range and was completed toward the end of 1947. As far as I know, the Soviets gave no specifications for the tunnel, and the dimensions of the tunnel were therefore determined by the equipment and materiel made available by the Soviets. Consequently, there were some differences between the Kammersdorf and the Krasnoarmeyskiy versions. For example, the latter was smaller and less elaborate; also, the Krasnoarmeyskiy tunnel did not have a heat exchanger which made the Kammersdorf tunnel much more universal in its application.

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12. The TROMMSDORF wind tunnel was a radical departure from the standard tunnels, such as the supersonic tunnel of the Technische Hochschule in Aachen, with their characteristic thick-walled containers that are evacuated and into which air then enters in sudden bursts. Instead, the TROMMSDORF tunnel used a battery of steel, compressed air bottles to store air which could suddenly be released in short bursts to the tunnel. The TROMMSDORF tunnel would have the advantage of permitting work with a certain amount of pressure while conventional tunnels operated mostly under vacuum. The purpose of the TROMMSDORF tunnel was three-fold: (a) performing of thermodynamic tests to study the burning process; (b) obtaining the drag and lift coefficients of projectiles at various angles of incidence; and (c) opportunity for studying the absorption and location of shock points along the missile. This latter was done by means of schlieren-photographs.

Description of TROMMSDORF Tunnel

13. The tunnel was located on the test range of KB-3 and is identified as Point 1 on the over-all sketch of the test range [page 10]. It was a single-story structure, 20 m. x 8-10 m. The roof of the building was slightly gabled and had a height of approximately 3 1/2 m. These dimensions as well as the itemized outline which I have presented below are not very accurate, since they are based on a single, brief visit within the building. I have drawn a second sketch showing the layout of the tunnel building and the points below relate to those used in this sketch [see page 11]:

Point 1 Room containing the battery of air bottles. The number of bottles and their volume is not known to me.

Point 2 Room containing the electrical motors used for driving the high pressure compressors located in the adjacent room (Point 13).

Point 3 Room containing three high pressure compressors. Capacity is not known to me.

Point 4 Room containing the control instruments for the adjustment of the cross-section of the test section. I believe that handwheels to operate the quick-acting gate valve and the regulating valves located in the adjacent room were located here. These valves assured a constant pressure over the test section. An armored glass covered an observation slit in the wall of this room.

Point 5 Pressure regulator located in room (Point 4).

Point 6 Electrical control desk located in room (Point 4).

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Point 7 Observation slit enclosed with armored glass.

Point 8 Armored room containing the measured test section. I believe I saw the following instruments arranged in the order presented on the sketch:

- a. unidentified unit
- b. diffuser
- c. Pitot tube with a diameter of 220 to 250 mm.
- d. exhaust device.

Point 9 Wooden wall.

Point 10 Use of this area of the building is not known to me, but I believe that this room is a wooden frame extension of the tunnel.

14. In addition to the equipment identified on the sketch the tunnel was provided with instruments for schlieren-photographs. Successful photographs were made by TROMMSDORF and later by an unidentified Soviet aerodynamicist stationed on the K3-3 range /see Para. 17 below/. Furthermore, the tunnel was provided with a balance for thrust measurements. This was not a three component scale, but I do not know any other details. Two vibrator oscillographs were available which focused their beams onto photosensitive paper. I believe that TROMMSDORF had made plans to install a heat exchanger in the wind tunnel, but I do not know whether this plan was carried out.

Operation of the Tunnel

15. The operation of the wind tunnel is not clear to me. I believe that the compressors required three to four hours operation for a test which would last only for a period of twenty or thirty seconds. It then became necessary to operate the compressors again for three to four hours before another test could be made. This was due to the compressors' low capacity. What this capacity was is not known to me, but I believe that the motor was of the order of 8 kilowatts. The critical cross-section was a square of 10 cm. The Pitot tube had a diameter of approximately 22 mm. Pressure observations were recorded by electrical instruments. The drag on the test model was transmitted onto these electrical instruments and a vibrator-oscillograph.
16. The TROMMSDORF tunnel was designed to achieve supersonic flow. In the rear of the jet, TROMMSDORF had installed an injector to prevent turbulent flow, and when the high pressure was exploded to a low pressure, he was able to reach supersonic speeds.

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Soviet Critique of the Wind Tunnel

17. The Soviets showed immense interest in the tunnel; several visits were made by unidentified Soviet officials from Moscow. They examined the installation and received briefings on its operation from Dr. FROMMSDORF. Also, shortly after the completion of the tunnel, an unidentified Soviet aerodynamicist was assigned to the test range of KB-3. I do not know anything of his activities there except that he had his office in the tunnel installation. I do know, however, that FROMMSDORF thought very little of the technical caliber of this Soviet.
18. Although interested in the tunnel, the Soviets did not fully exploit the opportunities offered by the tunnel and generally were skeptical of it. At first the Soviets apparently had great doubts as to whether a tunnel built on this principle could even reach supersonic speeds. As I have mentioned see Para. 16, FROMMSDORF, according to statements he made to me, was able to pass the sonic barrier with the use of an injector. In spite of this success the Soviets refrained from seriously using the tunnel. This may have been due to the following aspects of the tunnel which they criticized:
 - a. The Soviets maintained that the measurements obtained in this tunnel were not sufficiently accurate for their purposes. As far as I can judge, however, this was not an inherent fault of FROMMSDORF's design but rather the fault of the very primitive measuring instruments supplied by the Soviets.
 - b. The chief of KB-3, DAVIDNEV (not a technician but who sometimes had astounding comprehension of technical problems), once explained to me that the wind tunnel was not appropriate, that the design was not suitable and that the servicing of the tunnel was too complicated. He asked our group to redesign the wind tunnel along more modern principles. Specifically, he asked us to devise other regulating valves which would contain the necessary damping components. These valves were to be automatically controlled by means of electromotors so that the valves could be operated from a room which was totally armor-plated. For a very short period our group was preoccupied with this problem, working in cooperation with Dr. FROMMSDORF. As far as I know, however, none of our suggestions were acted upon, and I can no longer recall any details of the designing ideas offered by my group.

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Utilization of the Wind Tunnel

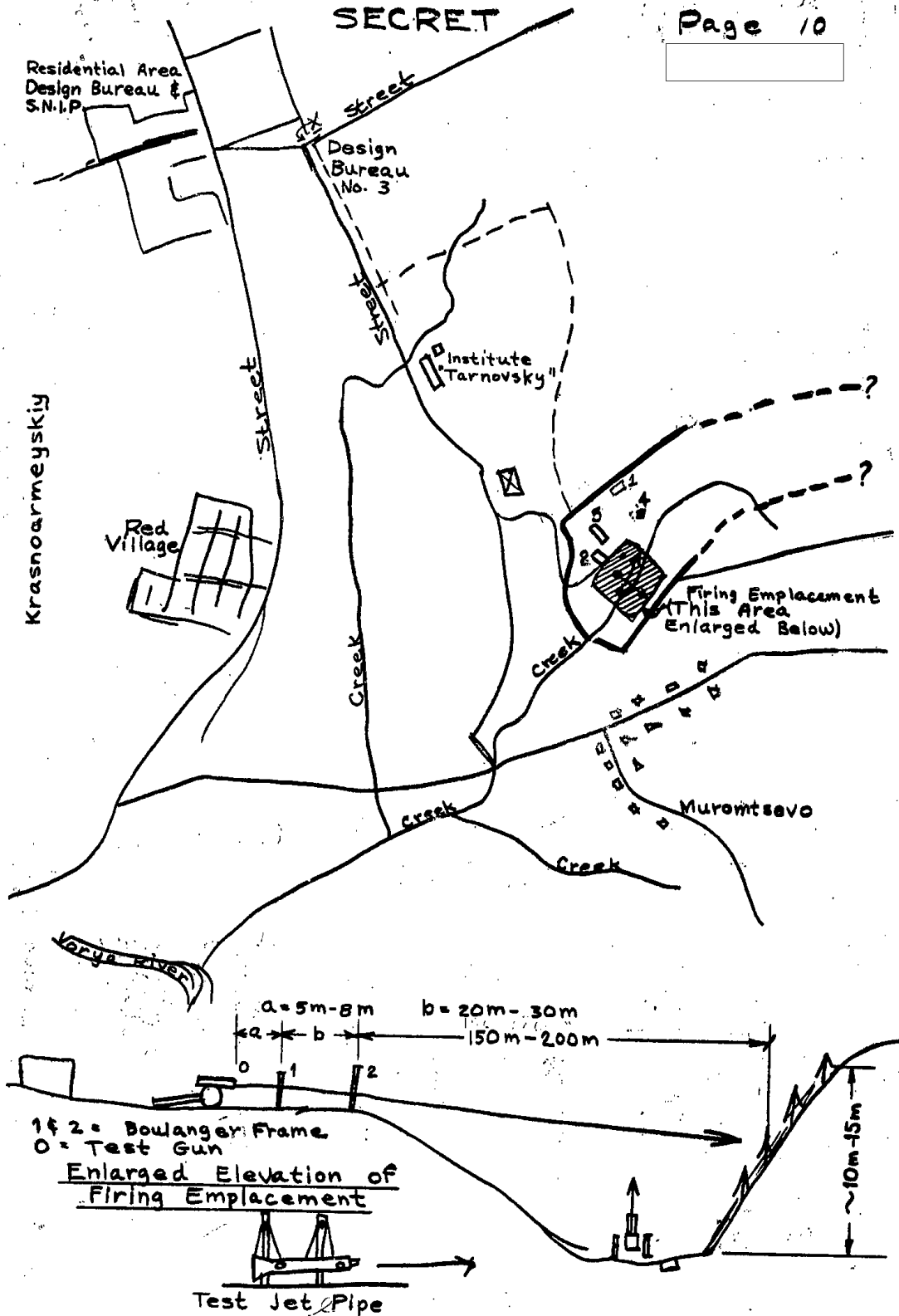
19. According to TROMMSDORF's statements, the tunnel was ready for operation by the end of 1947. The Soviets, however, did not make real use of the tunnel; nor did they permit the German specialists at KB-3 to utilize the facilities. The German specialists were very much interested in using the tunnel. Our group, for example, thought that the tunnel might be of use in testing the operation of the "Ring Magazine" (air-to-air missile) since the projectiles were to be fired at supersonic speeds. We had hoped that the tunnel tests would indicate to what extent it was permissible to decrease the fin surfaces or even help us determine the contours that would offer stable trajectory without the use of fins. In using the tunnel we planned to provide a gimbal suspension for a small scale model so that the frequency and period of the pendulum swings could be registered. We submitted the plans to the chief of KB-3 who asked for drawings of the small scale model, which we then prepared. However, permission to carry out the proposed test was never granted. We also considered using the tunnel when working on the design of "Sokol", an air-to-air missile, but dropped this idea in view of the paucity of instruments at the tunnel. Qualitative tests might have been feasible but not quantitative tests.
20. On the whole it was evident that the Soviets did not want the German specialists to use the tunnel and our frequent requests for permission to use it were turned down with flimsy excuses. Nevertheless, some use was made of the tunnel. TROMMSDORF made some tests, but as far as I know, these were qualitative tests only. Also, as mentioned earlier, he took some schlieren-photographs of the flow-about. I am certain that the Soviets used the tunnel, even though whenever I was on the range site, I never saw the tunnel in operation. What was tested by the Soviets is not known to me.

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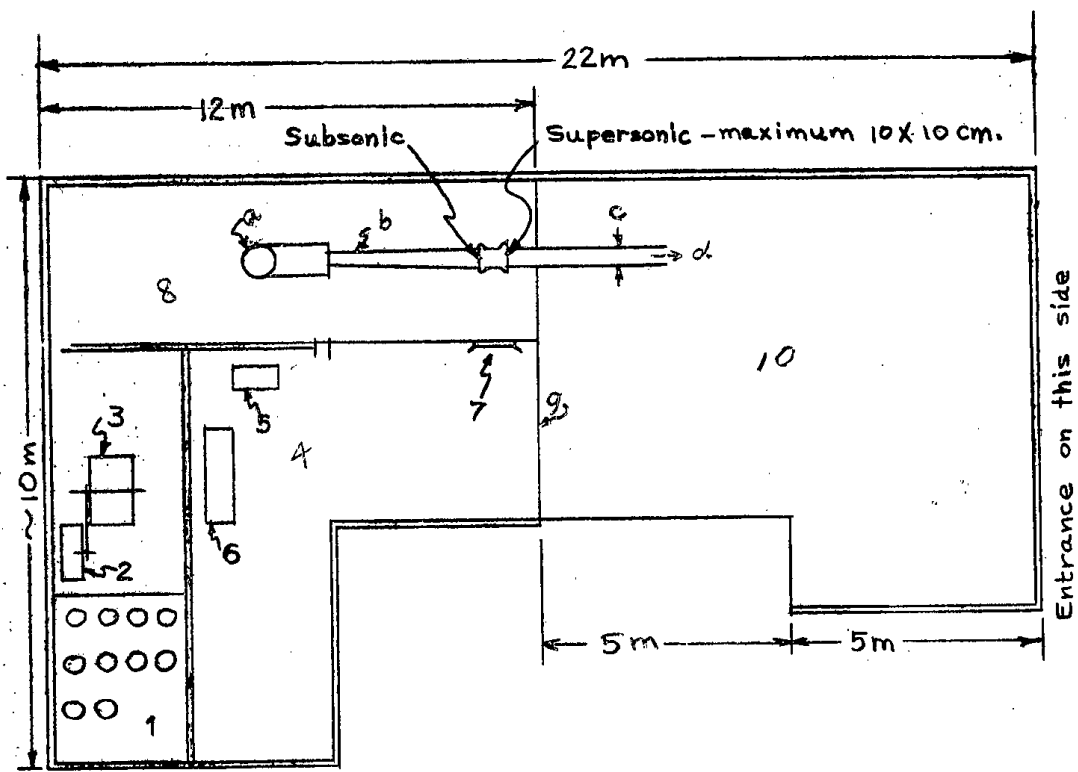
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TROMMSDORF'S SUPERSONIC WIND TUNNEL

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